

Application No. 10/039,309
Amendment dated
After Final Office Action of April 6, 2007

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Docket No.: 56682(45672)

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Amendments to the Claims

This listing of claims will replace all prior versions, and listing, of claims in the application.

Listing of Claims

1 (Previously presented). A liquid crystal display device, comprising: a liquid crystal layer; a pair of substrates provided so as to interpose the liquid crystal layer therebetween; and a plurality of pixels arranged in a matrix pattern, wherein:

the liquid crystal layer has a helical structure and exhibits at least two stable states including a planar state and a focal conic state according to an applied voltage; and

in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two different values, and the liquid crystal layer includes at least two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state,

wherein the thickness d of the liquid crystal layer satisfies a relationship of $1 < d/P < 15$ with a helical pitch P of the helical structure, and

wherein the thickness d of the liquid crystal layer is defined so that V_{thFmax} is less than V_{thHmin} in each of the plurality of pixels, where V_{thFmax} denotes the first threshold voltage for transitioning the liquid crystal layer included in a region with a largest thickness d of the liquid crystal layer from the planar state to the focal conic state, and V_{thHmin} denotes a second threshold voltage for transitioning the liquid crystal layer included in a region with a smallest thickness d of the liquid crystal layer from the focal conic state to a homeotropic state,

whereby the liquid crystal display device is capable of performing a gray level display or a multiple gray level display.

2-3 (Canceled).

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4 (Previously presented). The liquid crystal display device of claim 1, wherein a value of the thickness d of the liquid crystal layer increases from the center of the liquid crystal display device to each end of the liquid crystal display device, and said increase in thickness is effected by a succession of a plurality of substantially flat or substantially horizontal regions in a pixel electrode that provides a staircase pattern that rises from each of said ends to said center of the liquid crystal display device.

5 (Original). The liquid crystal display device of claim 4, wherein a difference Δd between the at least two different values of the thickness d of the liquid crystal layer satisfies a relationship of $0.5P \leq \Delta d$ with the helical pitch P of the helical structure.

6 (Original). The liquid crystal display device of claim 1, wherein a value of the thickness d of the liquid crystal layer changes continuously across each of the plurality of pixels.

7 (Original). The liquid crystal display device of claim 1, further comprising a pair of alignment layers provided respectively on the pair of substrates on one side thereof that is closer to the liquid crystal layer, wherein one of the pair of alignment layers is a horizontal alignment layer, and the other one of the pair of alignment layers is a vertical alignment layer.

8 (Previously presented). The liquid crystal display device of claim 1, wherein at least one of the pair of substrates includes a concave or convex surface on one side thereof that is closer to the liquid crystal layer than the other side.

9 (Previously presented). The liquid crystal display device of claim 1, wherein the pair of substrates both include a concave or convex surface on one side thereof that is closer to the liquid crystal layer than the other side thereof.

10-12 (Canceled).